DRAINAGE PATTERN AND FLOW ESTIMATION AT SECTION 1, BANDAR BARU BANGI

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I/We* hereby declare that I/We* have checked this thesis/project* and in my/our* opinion, this thesis/project* is adequate in terms of scope and quality for the award of the Bachelor Degree of Civil Engineering

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I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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ABSTRAK

Sistem perparitan adalah sistem penting yang berfungsi untuk mengawal air larian permukaan dan mengurangkan kesan buruk ke permukaan bumi. Sistem saliran yang betul adalah penting untuk menguruskan air larian permukaan. Gangguan alam semulajadi akibat kegagalan sistem perparitan akan mengakibatkan beberapa masalah seperti banjir, hakisan, bau dan bahaya kesihatan. Banjir mengakibatkan limpahan air akibat sistem perparitan yang tidak betul. Ia adalah masalah biasa yang membawa bahaya kepada kawasan kampung, bandar atau kawasan lain yang dihuni. Kawasan kajian dalam projek ini adalah di Bahagian 1, Bandar Baru Bangi. Kawasan kajian ini dipilih sebagai kawasan tadahan kerana kawasannya yang tidak lebih dari 80 hektar. Objektif kajian ini adalah untuk mengenalpasti corak saliran di kawasan tadahan kecil ini dan untuk menentukan masalah yang ada mengenai sistem perparitan di kawasan kajian. Kaedah yang terlibat boleh dibahagikan kepada dua, iaitu pengiraan dan simulasi. Dalam kaedah pengiraan, kaedah yang terlibat adalah kaedah Rasional dan Formula Manning. Kaedah Rasional digunakan untuk mengira pelepasan puncak manakala Formula Manning digunakan untuk kapasiti saliran. Perbandingan antara pelepasan air larian sub-tadahan dan pelepasan saliran mampu mengesan dan menyelesaikan saliran yang menghadapi masalah limpahan. Sementara itu, kaedah simulasi adalah dengan menggunakan perisian HEC-HMS dan HEC-RAS. Hasil dari simulasi menggunakan kapasiti 2 tahun, 5 tahun dan 10 tahun selang pengulangan purata menunjukkan bahawa ada beberapa saluran yang bermasalah di kawasan kajian yang memerlukan reka bentuk semula.

ABSTRACT

Drainage system is important systems which function to control surface runoff and decreasing the bad effect to earth surface. Proper drainage system is important to manage surface runoff while improper drainage system will causes some problem to environment such as flooding, erosion, odor and health hazard. Study area in this project is at Section 1, Bandar Baru Bangi. The objectives of this study case are to determine the drainage pattern, to estimate the maximum flow of the drainage system and to check the drainage capacity of 2 years ARI, 5 years ARI and 10 years ARI in the study area. The methods involved are the Average Rainfall Station, Rational Method and the Manning's Formula. The Average Rainfall Method is used to identify the missing value in the rainfall data provided by Department of Irrigation and Drainage Malaysia. The Rational Method is used to calculate the peak discharge while the Manning's Formula is used to determine the capacity of drainage. The result of this study is to justify whether the existing drain are still able to support the amount of rainfall intensity the design of the drainage can support the intensity of the rainfall.

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LIST OF SYMBOLS

n	Manning roughness coefficient
Q	Discharge
A	Area of stream or canal
v	Velocity of stream or canal
C	Runoff Coefficient
I	Rainfall Intensity
R	Hydraulic Radius
P	Wetted Perimeter
S	Channel Slope

LIST OF ABBREVIATIONS

ARI	Average Recurrence Interval
MSMA	Urban Stormwater Management Manual for Malaysia
DID	Department of Irrigation and Drainage Malaysia
WD	Water Distribution
MPKj	Majlis Pembandaran Kajang
CH	Chainage

CHAPTER 1

INTRODUCTION

1.1 General

Drainage system has its own pattern which can be rectangular, parallel, trellis and dendritic. The pattern of the drainage may affect the flood prediction as different place may have different average rainfall thus suitable drainage pattern is needed to less likely to have lower percentage of flood. The local topography and geology surface also may affect the drainage pattern. The catchment area function as water basin to minimize the flow of water and to trap the sediment.

This study is about drainage pattern and flow simulation and estimation on flood at Section 1, Bandar Baru Bangi, Hulu Langat, Selangor. It focused on drainage or open channel to flow water in case of rainfall. The drainage system in this area directly transfer to the nearest river to end the flow of the drainage. The urban area drainage uses the same concept as natural parts in flow but substitute it with lined drain, pipe, swale and inlet. Concrete drain and expected of stimulation flood in 2, 5 and 10 years Average Rainfall Intensity (ARI).

Flow estimation is important to ensure that catchment area of drainage system is safe and can contain the water flow of the rainfall in its major and minor system design. Major and minor system design is depended on the area of drainage and its design criteria.

1.2 Problem Statement

Improper drainage system will cause some problem to environment. Disturbance of the natural due to drainage system failure will result in disaster and occurences such as flash flood, overflow, erosion, odors and health problem.

Some of occurrences of the flash flood have happened recently in our country which is in Kuala Lumpur and Pulau Pinang. The flash flood has made a lot of damage to the city, car and others electrical appliances. The flash flood in Pulau Pinang that happened in Georgetown started with a non-stop heavy rain that covered a few district or area of the town in flash flood. The heavy rain started at 2 pm give a rise of the water level as much as 0.3 metres that makes the low-lying areas flooded. The flooded areas that have been affected due to this heavy rain is Jalan P.Ramlee, Lebuh Carnavon, Lebuh Muntri, Lorong Kinta, Jalan Anson, Lebuh Kimverly, Lebuh Mcnair and a few more areas in Seberang Perai. Figure 1.1 shows the flash flood at occurred in Penang. (Yaakob, 2017)

Recently, there was flash flood occur in the federal highway at Kuala Lumpur near the Mid Valley. It causes traffic jammed from Seputeh to Taman Desa and also in the main road around the Kuala Lumpur. This flash flood also affected the motorcycle user to cross the road as the water started to decrease 45 minute after the rain stopped. The Figure 1.2 shows the flash flood that occurred in the federal highway. (M Star, 2016)

It is important to decrease the occurrence of flood in a catchment area. Flash floods always occur in catchment area during heavy raining in long time period. Bigger catchment area will help to reduce the flow rate and decrease the percentage of flash flood to occur.

Flash flood may occur if the design is not according to minor and major drainage system. In Malaysia, these guidelines are made available in the Urban Stormwater Management Manual for Malaysia(MSMA).

This case study is to investigate drainage pattern system located at Section 1, Bandar Baru Bangi. There are many shape of drainage pattern that are being used in Malaysia such as parallel, dendritic, rectangular and trellis. The capacity of channel and pattern of the drainage system can affect the performance of drainage system. Thus, this study is focused on overflow problem and flash flood in a small catchment area.

Figure 1.1 Flash Flood In Penang

Figure 1.2 Flash Flood at Federal Highway near Kuala Lumpur

1.3 Objectives of the Study

The objectives of this study are:

- To determine type of drainage pattern in Section 1, Bandar Baru Bangi.
- To estimate the maximum flow of the drainage system in 2 years, 5 years and 10 years ARI.

REFERENCES

Akan, A. O. (2006). *Urban Hydrology, Hydraulics, and Stormwater Quality: Engineering Applications and Computer Modelling.* John Wiley & Sons.

Britannica, E. (n.d.). Retrieved 19 november, 2017, from https://www.britannica.com/science/centripetal-drainage-pattern

Chow, V. T. (1973). *Open Channel Hydraulics.* Inc: Mc Graw Hill.

Cotton, G. K. (20 February, 2009). *Engineering Hydrology*. Retrieved from U.S Department of Transportation Federal Highway Administration: www.fhwa.dot.gov/engineering/hydraulics

Engineers, U. A. (2018). *Hydrologic Engineering Center*. Retrieved 16 May, 2018, from Hydrologic Engineering Center: http://www.hec.usace.army.mil/software/

Engineers, U. A. (13 May, 2018). *Hydrologic Engineering Center*. Retrieved from Hydrologic Engineering Center: http://www.hec.usace.army.mil/software/hec-hms/

Flexiprep. (2015). *Flexiprep*. Retrieved 19 November, 2017, from https://www.flexiprep.com/NCERT-Exercise-Solutions/Geography/Class-9/Ch-3-Drainage-Part-1.html

Geologycafe. (2016). *Geology Cafe*. Retrieved 19 November, 2017, from Geologycafe.com

Gribbin, J. E. (1997). *Hydraulics And Hydrology For Stormwater Management.* New York: Delmar Publisher.

Guidelines, M. N. (n.d.). *Malawi National Guidelines*. Retrieved 23 11, 2017, from http://www.catchmentguidelines.org.mw/en/catchment-management/what-catchment

Halliday, R., Kouwen, N., Greppi, M., & Harsten, S. (2008). *Guide To Hydrological Pratices* (6th Edition ed.). World Meteorological Organization.

In, G. (2018). *Geology In*. Retrieved 24 February, 2018, from http://www.geologyin.com/2014/03/drainage-pattern.html

Killgore, R. T. (20 February, 2009). *Hydraulic Engineering.* Retrieved from U.S Department of Transportation Federal Highway Administration: www.fhwa.dot.gov/engineering/hydraulics

L.Garcíaa, J.-G.-M. (2015). Modelingandreal-timecontrolofurbandrainagesystems.

Livesly, M. (1960). *Field Drainage.* Binkerhead: Wilmer Brothers & Haram Ltd.

M Star. (22 july, 2016). Retrieved from M Star: http://www.mstar.com.my/berita/berita-semasa/2016/07/22/banjir-kilat-ibu-negara/

Maidment, D. (1993). *Handbook of Hydrology.* McGraw-Hill Professional.

Mays, L. W. (2001). *Water Resources Engineering.* USA: John Wiley & Sons.

Mike. (2017). Retrieved 2 November, 2017, from https://www.mikepoweredbydhi.com/about-us

MSMA. (2000). *Urban Stormwater Management Manual For Malaysia.* Kuala Lumpur: Department of Irrigation and Drainage Malaysia.

MSMA. (2012). *MSMA* (2nd Edition ed.). Malaysia: Department of Irrigation and Drainage.

Nalluri, F. &. (1988). *Civil Engineering Hydraulic, Essential Theory with Work Examples.* R.E. Featherstone & C Nalluri .

NRCS. (2016). Retrieved 19 November, 2017, from https://definedterm.com/radial_drainage_pattern

Raut., K. (2017). *Quora*. Retrieved 19 November , 2017, from https://www.quora.com/What-is-the-difference-between-rectangular-and-trellis-drainage-patterns

Ray, R. (2017). *Innovyze*. Retrieved 2 November, 2017, from EPANET 2 USER MANUAL

Science, S. (2016). *We and Our World*. Retrieved 19 November, 2017, from http://nishaaroradavloni.blogspot.my/2016/08/drainage-chapter-3-geography-9class.html

Sumramanya. (1995). *Engineering Hydrology.* New York: 1995.

Wallingford. (2007). *InfoWorks - Getting Started.* Wallingford Software Ltd.

Wurbs, R. a. (2002). *Water Resources Engineering.* USA: Prentices Hall.

Yaakob, F. F. (04 November, 2017). *BH Online*. Retrieved from Banjir Kilat Lagi di Pulau Pinang: https://www.bharian.com.my/berita/wilayah/2017/11/346360/banjir-kilat-lagi-di-pulau-pinang